

博士課程用 (甲)

(様式4)

学 位 論 文 の 内 容 の 要 旨

Dissertation Abstract

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(学位論文のタイトル) Title

Tumor control probability analysis for single fraction carbon ion radiotherapy of early-stage non-small cell lung cancer

初期ステージ非小細胞肺癌に対する1分割照射炭素線治療の腫瘍制御確立の解析

(「論文目録(様式3)」の主論文の部分を記載する。英文の場合は和訳をつける。)

For English paper, Japanese title is necessary.

(学位論文の要旨) 2,000字程度、A4判 (approx. 800 Words in English /A4 size)

Purpose: To investigate the suitability of the linear-quadratic (LQ) and universal survival curve (USC) models in describing the 3-year tumor control probability (TCP) data from stage I non-small cell lung cancer (NSCLC) patients treated with carbon ion radiotherapy given at a total dose of 59.4-95.4 Gy[RBE] in 18 fractions, 72 Gy[RBE] in 9 fractions, 52.8-60 Gy[RBE] in 4 fractions and 28-50 Gy[RBE] in a single fraction.

Materials and Methods: A meta-analysis of published clinical data from 394 patients presenting with early stage NSCLC was conducted. TCP modeling based on the LQ and USC models was performed by simultaneously fitting the clinical data obtained from the different fractionation schedules while considering several spread-out Bragg peak (SOBP) sizes. Radiobiological parameters were derived from the fit. Based on the results, a novel SOBP was created for the single fraction regimen that was optimized with respect to the USC model aimed at achieving a 95% local control.

Results: The USC model gave a better fit to the 3-year local control data. The fit using various SOBP sizes yielded transition doses between 5.6-7.0 Gy. The results also revealed α/β ratios between 7.4-9.1 Gy and 7.4-9.4 Gy for the LQ and USC models, respectively.

Conclusions: The USC model provided a better estimate of the local control rate for the single fraction course. For the schemes with more number of fractions, the local control rate estimates from the LQ and USC models were comparable. A USC-based SOBP design was then created for the single fraction schedule. The updated design resulted in a flatter RBE profile compared to the conventional SOBP design. It also gave a better clinical dose prediction to optimize the tumor control rate.